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EFFECTS OF THWARTING ON CARDIAC RESPONSE AND PHYSICAL AGGRESSION[1]

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This study examined the effects of various thwarting conditions on cardiac response and subsequent aggression. Subjects were asked to learn a list of nonsense syllables, with verbal reinforcement to be administered by a peer. Subjects received either an easy list with neutral comments from their peer, a difficult list with neutral comments from their peer, or a difficult list with derogatory comments from their peer. These conditions served to induce low-, moderate-, and high-thwarting conditions. The next phase of the experiment provided the subjects with the opportunity to reverse roles and teach their peer a list of syllables, with administration of shock as reinforcement. The results indicated that insult (high thwarting) enhanced both cardiac and aggressive responses, as expected. Low- and moderately thwarted subjects did not differ in physiological activation, thereby providing no support for the conjecture that frustration per se produces a physiological readiness to respond aggressively. The finding that low-thwarted subjects delivered more shocks to their peer than did moderately thwarted subjects was interpreted in terms of attribution theory. The need to specify conditions under which the motivation is to injure the other rather than to help the other learn (via aggressive responding) is emphasized. Several significant cardiac responses are discussed as supporting Elliott's notion that heart rate reflects activation or action instigation.

The notion that frustration leads to aggression has not been well supported, especially in situations where an overt aggressive response follows the frustration but does not facilitate attainment of some nonaggressive goal (Berkowitz & Le Page, 1967; Buss, 1963; Epstein & Taylor, 1967; Loew, 1967). The effects which have emerged in the study of the frustration-aggression hypothesis led Buss (1966) to contend that insult is the major antecedent of aggression and Berkowitz (1965) to propose that frustration, defined as interference with ongoing goal responses, is most likely to result in aggression in the presence of strong, aggressive cues (internal or external). Geen and Berkowitz (1967) have argued specifically that frustration produces a readiness to respond aggressively, a predisposition which, with appropriate cues, leads to aggression.

Does this readiness manifest itself in increased tension or physiological activation? Hokanson and his colleagues (Hokanson & Burgess, 1962; Hokanson & Shetler, 1961) have demonstrated that a condition involving harassment and failure increased physiological activation, but they did not examine the effects of frustration alone on activation. Furthermore, they did not demonstrate changes in aggressive responding concomitant with physiological changes (Hokanson & Burgess, 1962).

Epstein and Taylor (1967) found that a partner's perceived aggressive intent, but not defeat alone, in a game intensified aggressive and physiological responses. Because the notion that frustration predisposes a person toward aggression is a part of current theory (Berkowitz, 1969), the possibility of concomitant physiological activation demands continued exploration. The purpose of this study was to examine the effects of three thwarting conditions, two involving frustration and one involving frustration plus insult, on cardiac response and subsequent aggression. It was expected that insult would enhance both overt aggressive and physiological responses, whereas frustration would intensify only physiological activity.

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METHOD

Subjects

The subjects were 90 men, who participated for $1.50 or one experimental credit toward an introductory psychology course requirement. Seven other subjects also participated, but their data were discarded because of their suspicion.

Procedure

The subject was taken to the experimental room by a male experimenter and seated at a table. The subject was led to believe that another subject, who was presumably seated in the adjoining room, would be his partner. This other subject was fictitious. His remarks and responses were tape-recorded and played back by the experimenter via a silent foot pedal at the appropriate times.

The experimenter explained to the subject that his heart rate would be recorded throughout the experimental session. Two active and one ground electrode were then placed on the subject's chest, and a 2-minute recording of the subject's heart rate was taken on a Sanborn 51 Viso-cardiette. Although Lacey, Kagan, Lacey, and Moss (1963) have argued for the inclusion of galvanic skin response as a measure of arousal because of directional fractionation, especially when the subject is relaxed, heart rate was used for several reasons. Heart rate is less subject to artifacts than galvanic skin response and is more reliable than surface blood pressure measures. It has reflected stress and arousal effects (Blatt, 1961; Corfield, 1969; Malmo, 1965; Schnore, 1959) and, more relevant to this study, activation effects (Elliott, 1969).

After returning to the experimental room, the experimenter moved behind a curtain which shielded him from the subject's view. From this position, the experimenter read the initial instructions and operated the tape recorder and Viso-cardiette.

The subjects were told that the experimenter was interested in the effects of different kinds of reinforcement upon learning, and in order to control the influence of extraneous variables, such as gestures or facial expressions, they had been placed in separate rooms. The subjects were told that they could communicate with each other by means of a loudspeaker system connecting the two rooms. To justify the recording of heart rate, the subjects were informed that the experimenter was also interested in the physiological responses which occur during learning.

The subjects were instructed that in the first part of the experiment, the critical subject would serve as the learner, while the other subject would serve as teacher; in the second part of the experiment, the subjects were to exchange roles. The experimental task involved either teaching or learning a list of 10 nonsense syllables. The teacher was to read the list to the learner, who would then repeat as many of the syllables as he could remember. The teacher was then to reinforce the learner by giving feedback. In the first part of the experiment, the teacher was to give the critical subject verbal feedback, relating to the subject how well he had done. Subjects were told that the method of reinforcement for the second part of the experiment would be described later. The subjects were instructed to continue the learning trials until they were signaled by the experimenter to stop.

Following the instructions, the thwarting manipulation was introduced. One-third of the subjects learned a list of easy nonsense syllables, selected from Glaze's (1928) lists having higher association values (low thwarted), while another third attempted to learn a list of difficult syllables, selected from Glaze's lists having lower association values (moderately thwarted). All of these subjects received neutral comments (e.g., "Well, that's O.K.—let's do it again") as feedback on their performance from their partner. The remaining third of the subjects attempted to learn the same difficult list, but received very critical comments on their performance from their partner (high thwarted). The comments, delivered after each trial, were as follows:

> [Trial 1] O.K. I think we're going to be here for a long time. But let's try it for the second time.
>
> [Trial 2] You still haven't got them all right—I'll read the list again, and *this* time try and *concentrate* a little more. It's really not very hard.
>
> [Trial 3] God! At the rate you're going, we're never going to get finished! I really don't think there's much point in continuing with this, do *you? Try harder* this time so that we can get out of here!! *All right* . . . I'm going to read them once more and this time, I'm going to read them so *slow* that even *you* can get them.

Considerable pilot work was done to obtain the desired affective tone for these comments and to ensure credibility.

For all subjects, the experimenter then moved a previously concealed shock box, a modified version of Buss's (1961) aggression machine, to the table at which the subject was seated.

The experimenter explained to the subject that in the next part of the experiment, he would assume the role of teacher and administer physical feedback (reinforcement) to his partner, who would assume the role of learner. The subject was also told that he could vary the intensity, number, and duration of shocks received by his partner. Intensity could be varied by adjusting the large center dial to the desired level (0–330 volts) and by then pressing the shock-delivery button. Eight descriptive labels indicated to the subject the approximate severity of shock associated with the varying voltage levels: slight shock = 0–55 volts; moderate shock = 56–110 volts; strong shock = 111–170 volts; very strong shock = 171–225 volts; intense shock = 226–280 volts; extreme intensity shock = 281–335 volts; danger = 336–400 volts; severe shock = 401–450 volts.

To decrease the likelihood of suspicion, a governor was attached to the shock box which prevented the subjects from turning the dial beyond the 330-volt level. Subjects were instructed that a maximum of 330 volts was available for their use. The number of shocks could be varied by pressing the shock-delivery button more than once; the duration of shocks could be varied by depressing the button for varying lengths of time. The delivery button was connected to two shunt-clock timers, one visible to the subject and the other visible to the experimenter behind the curtain. The shock-box dial was connected to a meter, visible to the experimenter, which indicated the intensity levels set by the subject.

The subject was given a sample shock of 45 volts to increase the realism of the situation. The experimenter then gave a list of 10 syllables to the subject and left the room, presumably to wire the partner to the shock apparatus. The list differed from the one previously learned by the subject, and no indication of its difficulty level was given by the experimenter. After 2 minutes, the experimenter returned, and the learning task commenced. The subject administered shock to his partner following each of three learning trials. In all conditions, the partner reported 3 syllables on the first trial, 5 syllables on the second trial, and 8 syllables on the third trial, for a total of 16 syllables.

The experimenter terminated the task at this point and asked the subject to rate his partner on a series of thirteen 7-point bipolar scales and to complete a questionnaire about the experiment. The questions included checks on the effectiveness of the thwarting manipulation, the subject's perception of the painfulness of shocks received by his partner, and the subject's suspiciousness. Following completion of the questionnaires, the subject remained quietly seated while 2 additional minutes of heart rate were recorded. The experimenter then removed the electrodes and thoroughly debriefed the subject.

RESULTS

Summary of Experimental Design

Ninety subjects were run in this 3 × 3 repeated-measures design, with 30 subjects in each cell. Dependent measures were (*a*) intensity, number, and duration of shocks; (*b*) changes in heart rate during the experiment; and (*c*) questionnaire ratings of the partner at the end of the experiment.

To assess the difficulty of the learning task, an analysis of variance was carried out on the subjects' actual learning of the syllables in the first half of the experiment. A significant main effect for thwarting emerged ($F = 12.39$, $df = 2/87$, $p < .005$). Low-thwarted subjects repeated more syllables than both high-thwarted subjects ($p < .001$, Duncan's multiple-range test) and moderately thwarted subjects ($p < .005$, Duncan's multiple-range test), thus providing a successful check on the manipulation of task difficulty. Moderately thwarted subjects tended to repeat more syllables than high-thwarted subjects ($p < .10$, Duncan's multiple-range test). The mean number of syllables (summed over trials) given by the low-, moderate-, and high-thwarted subjects was 20.40, 18.17, and 16.87, respectively.

The major dependent aggressive responses were the intensity, number, and duration of shocks, each of which was analyzed separately.

Intensity

Only the trials effect was significant ($F = 3.32$, $df = 2/174$, $p < .05$) in this analysis. More intense shocks were given on the second shock trial than on the first trial ($p < .05$, Duncan's multiple-range test). Mean shock intensity on the third trial did not differ significantly from the other means. The means for the first, second, and third trials were 84.72, 101.89, and 95.39, respectively.

Number

The thwarting main effect was significant ($F = 4.47$, $df = 2/87$, $p < .025$). Moderately thwarted subjects gave fewer shocks than both low-thwarted subjects and high-thwarted subjects ($p < .05$, for both comparisons, Duncan's multiple-range test). Subjects in the low- and high-thwarted groups did not differ from each other in the number of shocks given. The mean number of shocks given by low-, moderately, and high-thwarted subjects was 1.70, 1.17, and 1.64, respectively.

The Thwarting × Trials interaction also reached significance ($F = 2.56$, $df = 4/174$, $p < .05$). Low- and high-thwarted subjects increased the number of shocks delivered from Trial 1 to Trial 2 and then leveled off on Trial 3, while moderately thwarted subjects tended to decrease the number of shocks delivered over all three trials. Figure 1 shows the significant Thwarting × Trials interaction.

The absolute number of shocks administered by subjects in this experiment was quite low. Although the procedures (no feedback from victim and absence of the experimenter) were designed to facilitate display of aggres-

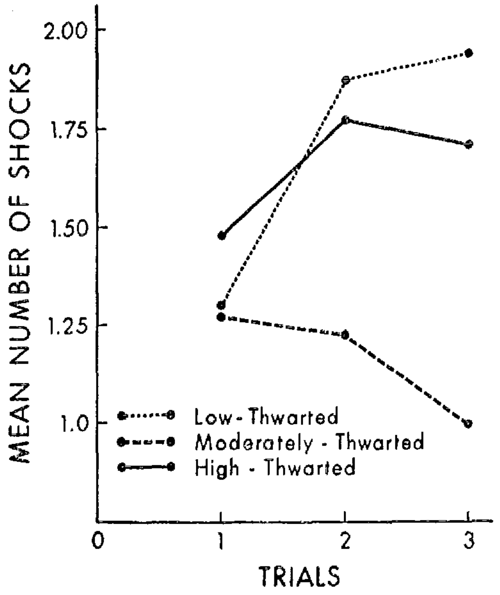

FIG. 1. Mean number of shocks given by low-, moderately, and high-thwarted subjects over trials.

sion, the instructions may have inadvertently inhibited use of shock. Or, perhaps the instigation was relatively mild.

Duration

None of the effects in this analysis yielded significant effects.

Questionnaire Data

Subjects rated their partners on a series of thirteen 7-point bipolar scales, with higher scores indicating more favorable ratings. An analysis of variance showed that the main effect for thwarting was highly significant ($F = 17.97, df = 2/87, p < .005$). High-thwarted subjects gave less favorable ratings to their partners than did moderately thwarted subjects or low-thwarted subjects ($p < .001$, for both comparisons, Duncan's multiple-range test). Ratings by moderately and low-thwarted subjects were not significantly different from each other. The mean ratings for high-, moderate-, and low-thwarted subjects were 4.26, 5.38, and 5.09 points, respectively.

Subjects responded to three postexperimental questions concerning anxiety, annoyance, and estimated painfulness of their partner's shock on 5-point scales. Analysis of the degree of annoyance felt during the experiment yielded a significant main effect for thwarting ($F = 7.66, df = 2/86, p < .005$). High-thwarted subjects indicated greater annoyance (mean rating of 2.67) than did low- and moderately thwarted subjects (mean ratings of 1.63 and 1.65, respectively, $p < .005$, extension of Duncan's multiple-range test to unequal replications; Kramer, 1956). The other two ratings did not yield significant effects.

Physiological Data

For statistical treatment, the 60-second time interval just preceding the experimenter's reading of the instructions was used as an estimate of base-line heart rate. The degree of change occurring during various events in the experiment was calculated by subtracting the average of the subject's base level from his average reading for the event and reflected change in beats per 5-second interval. In order to provide a uniform counting record, conducive to subsequent exploratory analyses as well as for comparison with results of other studies, heart rate samples were based on 5-second intervals of time (Davis, Buchwald, & Frankmann, 1955). These samples were consistently taken from the first, last, and middle (if possible) portion of each event, so that no biased selection of intervals occurred.

Analysis of variance yielded no significant differences in base levels for the three subject groups ($F = .23, df = 2/87$). Changes in heart rate due to the independent variables were then tested by analysis of variance.

Thwarting manipulation. Cardiac response during this period was measured by counting and averaging the first three, middle three, and last three 5-second intervals of heart rate during the syllable presentation, along with the first two and last two 5-second intervals during the verbal reinforcement period, for each of the three learning trials. The thwarting manipulation (partner teaching and reinforcing the subject) resulted in nearly significant heart rate differences among the three thwarted groups for the thwarting period ($F = 2.52, df = 2/87, p < .10$). High-thwarted subjects showed greatest increases, but did not differ significantly from the two other thwarted groups ($p < .10$, Duncan's multiple-range test, for both comparisons). The means, reflecting increases from base levels, were 1.16, .75, and .78 for high-, moderate-, and low-thwarted subjects, respectively.

Analysis of the thwarting event resulted in a highly significant trials effect ($F = 38.08$, $df = 2/174$, $p < .005$). Duncan's multiple-range test showed that heart rate increases were significantly greater ($p < .001$) on the first trial ($\bar{X} = 1.18$) than on the second ($\bar{X} = .77$) or third trial ($\bar{X} = .74$), thereby reflecting adaptation effects.

Shock instruction. Cardiac response during this period was measured by counting and averaging the first two, middle two, and last two 5-second intervals of heart rate during the instruction period. A significant thwarting main effect emerged in analysis of the shock-instruction event ($F = 6.91$, $df = 2/87$, $p < .005$). High-thwarted subjects showed significantly greater increases in heart rate for the shock-instruction period than did low-thwarted ($p < .005$, Duncan's multiple-range test) and moderately thwarted subjects ($p < .01$, Duncan's multiple-range test). The means, representing change from base levels, were .88, .35, and .23 for high-, moderate-, and low-thwarted subjects, respectively.

Presenting syllables. Cardiac response was measured by counting and averaging the first three, middle three, and last three 5-second intervals of heart rate for each of the three teaching trials. Analysis of the teaching event yielded a significant thwarting main effect ($F = 6.18$, $df = 2/87$, $p < .005$). High-thwarted subjects showed significantly greater increases in heart rate than both moderately thwarted ($p < .005$, Duncan's multiple-range test) and low-thwarted subjects ($p < .01$, Duncan's multiple-range test). The means for high-, moderate-, and low-thwarted subjects were .63, .08, and .16, respectively.

This same analysis revealed a significant trials effect ($F = 52.71$, $df = 2/174$, $p < .001$). Heart rate increases from base levels showed significant differences between the first ($\bar{X} = .49$), second ($\bar{X} = .27$), and third ($\bar{X} = .11$) syllable presentations ($p < .001$, for all comparisons, Duncan's multiple-range test).

TABLE 1

MEAN HEART RATE CHANGE (SYLLABLE PRESENTATION LESS BASE LEVEL SCORES) FOR THWARTING × TRIALS INTERACTION

Group	Trial 1	Trial 2	Trial 3
Low thwarted	.33	.13	.03
Moderately thwarted	.27	.01	−.05
High thwarted	.86	.67	.35

In addition, a significant Thwarting × Trials interaction emerged ($F = 2.88$, $df = 4/174$, $p < .025$). Table 1 presents the means for this interaction. These means show heart rate adaptation effects, with slightly differing slopes for the three thwarting conditions.

Administering shock. Cardiac response was measured by counting the two 5-second intervals of heart rate during the shock-delivery period for each of the three shock trials. Analysis of heart rate change scores for the shock event yielded a significant thwarting main effect ($F = 3.93$, $df = 2/87$, $p < .025$). High-thwarted subjects showed greater increase from base levels than did moderately thwarted subjects and low-thwarted subjects ($p < .05$, for both comparisons, Duncan's multiple-range test). The respective means for high-, moderate-, and low-thwarted subjects were .67, .12, and .26. This same analysis yielded a significant trials effect ($F = 4.45$, $df = 2/174$, $p < .025$). Heart rate increases were significantly greater on the first shock trial ($\bar{X} = .60$) than on the second and third shock trials ($\bar{X}$s $= .23$ and $.22$, respectively, $p < .05$, for both comparisons, Duncan's multiple-range test).

Postexperimental period. Analysis of heart rate during the postexperimental questionnaire period revealed no significant effects, nor did multiple-range tests reveal significant differences. Also, analysis of variance and multiple-range tests on heart rate during the final 2-minute recovery period yielded no significant effects.

Figure 2 depicts heart rate change from base line for each of the six events. Although adaptation effects are apparent after Event 2, the significant elevation of heart rate for the high-thwarted group, relative to the other two groups, is evident on Events 3, 4, and 5.

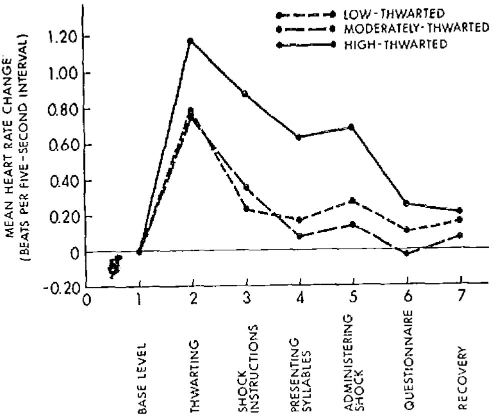

FIG. 2. Mean heart rate change from base level over six events.

DISCUSSION

The three thwarted groups did not differ in cardiac rate increases during the thwarting period. However, when made aware of the opportunity to aggress, the thwarted groups showed differential increases, with the high-thwarted group displaying greater elevation in heart rate than the other thwarted groups. This effect confirms Elliott's (1969) contention that heart rate might not reflect emotional tension level, except when responses can be initiated to cope with the arousal. The insulted subjects did not show significant increases over the other thwarted groups until they were told they could shock the other person, that is, that they could retaliate.

Differences among conditions were eliminated following shock delivery, thereby suggesting that cardiac recovery occurs only after the aggressive sequence has ended. While inconsistent with Holmes's (1966) findings that frustrated subjects maintain an elevated level of physiological arousal after aggressing, these results support Hokanson and Shetler's (1961) proposition that tension reduction takes place when a subject makes a response which is appropriate to the situation, as in overt aggression toward a frustrator. This study provides the additional information, however, that during the actual aggressive sequence, activation is high for insulted persons, as indicated by elevation of cardiac response throughout teaching and shocking the other person. As suggested by Elliott (1969), cardiac response seems especially sensitive to action instigation. An additional implication of these findings is that after terminating a series of aggressive responses, subjects who are then provided with an unexpected further opportunity to aggress may not be likely to express further aggression. Since their physiological tension has been reduced, strong aggressive cues or renewed drive arousal should be necessary to elicit aggressive responses.

Particularly relevant to the question posed in this study is the fact that moderately thwarted subjects, frustrated (operationally) by their failure on a task, did not differ from low-thwarted subjects in activation throughout the experiment. If these subjects were in a state of readiness, as proposed by Berkowitz (1965), it was not evident from their cardiac responses. What may be necessary for failure to serve as an activator is (*a*) a specific threat to self-esteem, as provided in the Geen and Berkowitz (1967) study, where subjects failed on a task which a peer had solved; or (*b*) the perception that the peer is the source of frustration (Dollard, Doob, Miller, Mowrer, & Sears, 1939; Lanzetta & Hannah, 1969).

In terms of aggressive responses, the low- and high-thwarted subjects delivered more shocks to their peer than did the moderately thwarted subjects. For the insulted subjects, the level of aggression was concomitant with increased heart rate and greater reported annoyance, so that their aggression seemed to reflect anger. However, the aggressive behavior of the low- and moderately thwarted persons must be understood in other terms. Apparently, their past performance on a similar task served as a comparison which led the subjects who succeeded (low thwarted) to expect that their peer could do well, and therefore shocked him to improve his performance, whereas those who failed (moderately thwarted) did not expect their peer to do well, and hence did not so reinforce him. This assumption is consistent with Lanzetta and Hannah's (1969) finding that attribution of ability to do a task because of competence led to increased shocks in a training task. These results suggest that although the amount of shock delivered in this situation may reflect aggression, in the sense of harming another person, it also reflects a tendency to use the shock as reinforcement for learning. Thus, experiments which are designed to measure aggression in terms of physical harm to another must include controls which will eliminate the operation of attribution effects. Furthermore, it is important to clarify the motivational basis for the delivery of shock in a situation, so that the *intent to injure,* rather than to help, the person can be unambiguously inferred. If one considers the amount of pain delivered by shock as a sufficient definition of aggression, then the results of studies so far demonstrate that insult, some types of task failure, and attribution increase aggressive responding. However, if one wishes to clarify whether the intent to physically injure is prepotent to the intent to teach or train, then experiments which unconfound these must be designed.

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